Technical Paper
May 2000

IMPLEMENTING
the
SPATIAL DATA STANDARDS FOR FACILITIES, INFRASTRUCTURE, AND ENVIRONMENT (SDS)
and
FACILITY MANAGEMENT STANDARDS FOR FACILITIES, INFRASTRUCTURE, AND ENVIROMENT (FMS)

using

BENTLEY'S MICROSTATION GEOGRAPHICS (MSGG)

Final Draft

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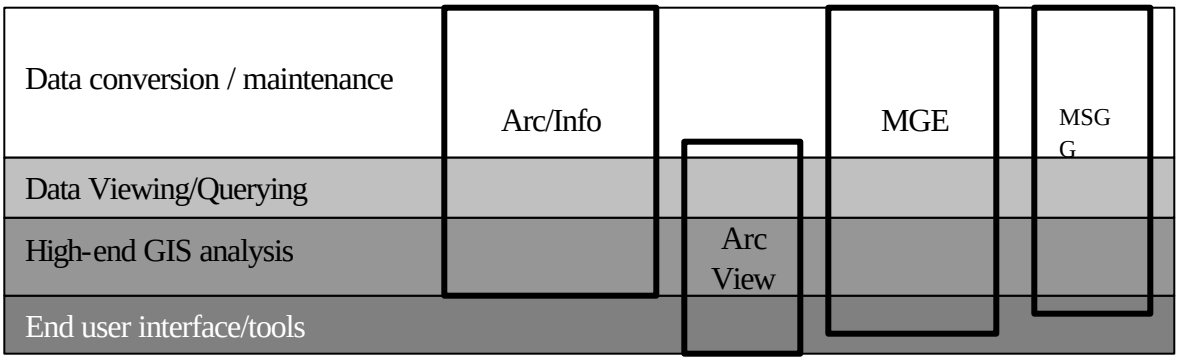
1 MicroStation GeoGraphics

MicroStation GeoGraphics (MSGG) is a multi-purpose GIS data maintenance, manipulation and analysis software package from Bentley Systems, Inc. MSGG is a high end GIS package that was designed as more of an application development tool-kit, than a customized end-user program. It was designed to be customized by the user for a wide range of Geoengineering applications.

MSGG is seamlessly integrated with MicroStation. Therefore, it features all of the MicroStation data capture and editing tools and is compatible with Bentley's other geoengineering products. Enhancements to the standard MicroStation functions include tools for data input, validation, management, analysis, and visualization. In addition to vector data handling, advanced capabilities include raster data management. These data are organized into projects, which contain all graphic and attribute data and related settings.

The MSGG data model is similar to that of Intergraph's MGE product in its approach to describing and managing spatial data. Graphic data is stored in CADD files (.dgn format) and attribute data in a Relational Database Management System (RDBMS). The graphic/attribute data relationships and the integrity of the GIS model are managed by a set of system metadata in the RDBMS and the application environment.



(The size of the boxes suggests the number of modules, complexity, processing/analyzing power and price of the software package.)

When setting up the project and the components properly, this structure remains transparent to the user. Due to its MicroStation foundation, the GIS data is presented to the user in a CADD environment, and the basic foundation is determined by the CADD data design. Data is grouped by features as individual layers in a file and again by broader categories in individual files. Attribute data is linked to elements by unique identifiers and can be stored in any SQL-compliant RDBMS, such as Oracle, Informix, SQL Server, or Microsoft Access. This type of structure is well suited to and benefits greatly from standardization.

Implementation choices

The Spatial Data Standards/Facilities Management Standards (SDS/FMS) is a geographic data model that relates spatial (graphic) and tabular (attribute) data, and thoroughly accommodates the CADD-based GIS model. While the SDS/FMS does not address the MSGG model specifically, the database can still be 100% compliant. The MSGG model is flexible and the SDS/FMS includes implementation methods for both MGE and MicroStation.

In order to recommend the best workflow for adopting the SDS/FMS for MSGG, the primary differences between MGE, MicroStation and MSGG and their relevance to implementing the SDS/FMS model need to be reviewed. While these three applications have the same foundation (spatial features in .dgn files and attribute tables in a RDBMS), they have different interfaces, tools and workflows.

MicroStation
MicroStation is fundamentally a CADD product with an option to link elements to RDBMS databases. There is no GIS data structure included or enforced within the MicroStation environment, and it is not recommended for GIS data processing. As introduced above, MSGG is the GIS module of MicroStation and provides the GIS functionality to maintain a robust model and perform full-scale analysis.

MGE
MGE is a modular GIS environment, the first and most widely used CADD-based GIS application. MSGG's model was inherited from MGE, but due to its reduced and compact functionality, and newer application structure, the two applications have some profound differences. Data processed in either environment will not be fully readable and functional in the other application without some conversion, decomposition and rebuilding of the dataset. The main system features that differentiate MicroStation GeoGraphics from MGE are its additional system tables and the way it stores and handles topology.

However, the SDS/FMS only specifies the data nomenclature, symbology and attribute table structure; the model in which the elements are managed and processed is determined by the application. Therefore, these differences do not affect the implementation.

The MicroStation and MGE implementation methods of the SDS/FMS are similar and both applicable for the MSGG adoption of the Standards. Due to MSGG's inherited MGE data model, it is recommended to use the choices for MGE in the SDS/FMS workflows. There are a few instances where output from the Standards is not available for MGE. Those instances are identified in the SDS/FMS implementation workflow in this guide, and the MicroStation option is recommended for use.

2 Implementing the SDS/FMS – MSGG Setup

In order to use this guide, the user should be familiar with the MicroStation GeoGraphics data and project structure. The procedures below describe what components and steps are required within the MSGG environment, but it is assumed that for technical details the MSGG User's Guide will be used for a reference.

2.1 Main Software and Data Components for Implementation

The following components are required for the SDS/FMS MSGG setup:

Software

- MicroStation (J, SE or 95)
- MicroStation GeoGraphics (Version J, SE or 95)
- RDBMS (Microsoft Access 97 is used in the setup example)
- Microsoft ODBC Driver Pack 3.51
- SDS/FMS Release 1.90

Data

- MicroStation design files
- Attribute data in RDBMS
- Descriptive metadata (optional)
- SDS/FMS Release 1.90 data (bundled with application)

2.2 SDS/FMS Implementation Scenarios

Different scenarios require different implementation strategies depending on the data type (graphic or attribute) and format (hardcopy or digital). The following four implementation scenarios exist in a traditional data maintenance environment: (1) source documentation for graphic and attribute information that exist, but are not in digital form; (2) graphic data have yet to be digitized, but related attribute values are available in electronic form; (3) graphic data are in digital form, but related attribute data are not; or (4) graphic and attribute information have been digitized. To implement any of the above scenarios, a user must have a clear understanding of MSGG and the SDS/FMS.

2.3 MSGG Project Setup Example

The following example refers to an implementation scenario where both graphic and attribute information have been digitized. The graphic data exists in MicroStation design (.dgn) files and the attribute data exists in a database (i.e., RDBMS or convertible into RDBMS).

In order to build an SDS/FMS compliant database, a clean project should be built. Any existing MSGG, MGE or other GIS dataset can be converted and/or decomposed to MicroStation design files and database tables. If elements were previously associated with attributes, it should be assumed that all the elements have unique linkages. In order to verify and test the implementation steps, a sample dataset was setup and introduced for this document.

2.3.1 MSGG Project and Application Structure

2.3.1.1 MSGG Data Structure

The MSGG data structure has the following components:

Project

An MSGG project is a group of settings and information stored in system tables through which the application manages design files and attribute data. These data are represented by the following terms:

- **Categories**
  Categories, within MSGG, represent a group of thematically or geographically related features or maps. In SDS/FMS, categories are related to Entity Classes and each category can have one or more maps.

- **Maps**
  Geographic information is stored in the MSGG system as maps. These maps or groups of maps represent categories of graphic information and also relate to Entity Classes in the SDS/FMS. MSGG stores the graphic data in MicroStation design files (.dgn).

- **Features**
  Features are spatially distributed geographic elements that make up a map. Feature types that are closely related make up subcategories referred to as Entity Types in the SDS/FMS. By the SDS/FMS definition, features are individual elements represented on the map as points, lines, polygons, text and attribute information, and may be associated with an attribute table. These features are classified in the SDS/FMS as Entities.

- **Attributes**
  Attributes are non-graphical information describing features and files or relating to features and files. Attributes are stored in attribute tables.

Application Structure

The MSGG application is fully integrated with MicroStation. Unlike MGE which has multiple applications for multiple modules, MSGG contains all modules (project setup/management tools and functions) within one application window. The main module required for the setup procedure is the Project Setup performing the following steps:

- Directory and database setup
- Feature and Category setup
- Map setup and registration

Additional data analysis and maintenance tools, functions and settings used subsequent to the SDS/FMS feature, category and attribute table setup are not discussed in this paper. The following steps should be followed to establish the appropriate MSGG working environment.

2.3.2 Setup Steps

2.3.2.1 Directory and Database Setup to Create Project

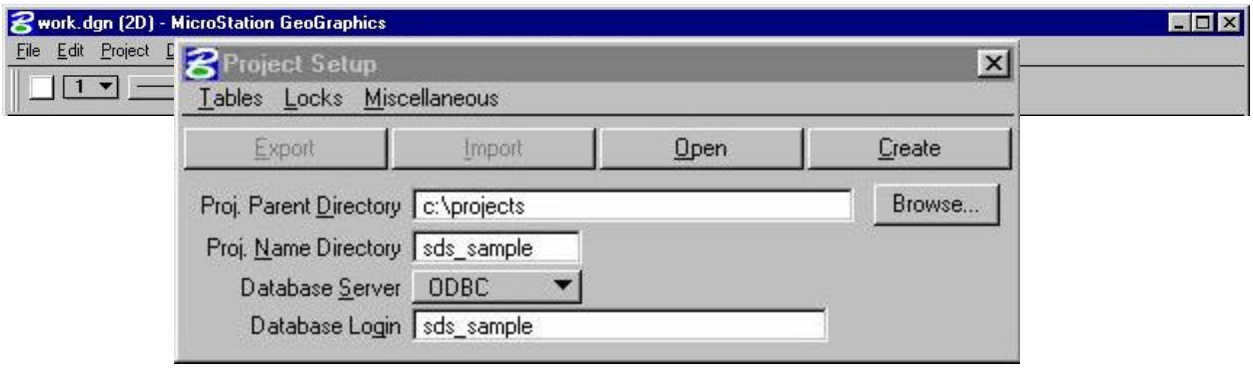
The first step is to create a project. The components of a MSGG project are:

- A directory structure
- A set of tables in the attribute database

MSGG automatically creates these components in the following steps. To begin, select Setup from the Project menu.
(see images below for examples)

- Enter the project location (first the parent directory, then the project directory).
- Enter the database login string. If an ODBC connection is used, a Data Source Name has to be setup first in the ODBC Data Source Administrator environment.

- Click Create. The project directory structure and the following tables will be created: CATEGORY, FEATURE, MAPS, COMMANDS, MSCATALOG, TABLES_CATALOG, and JOIN_CATALOG.



2.3.2.2

Setup categories and features

From the Tables menu, select Feature Setup. The following Feature Setup dialog box will be invoked:

Categories and feature names can be entered in the Feature Setup dialog box. Since the SDS/FMS category and feature definition will be used, it will be imported separately. However, this dialog is useful when adding individual features.

2.3.2.3 Map setup

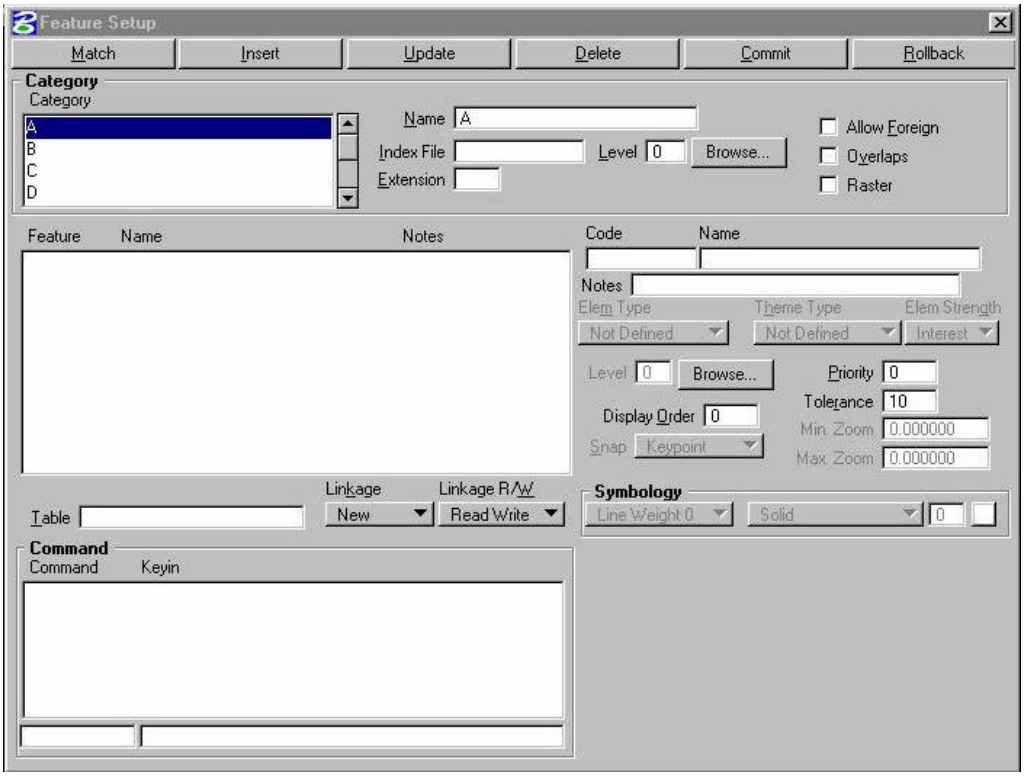
The project has to be opened through the project setup dialog. The design files have to be moved under the project parent directory into the dgn directory.

- From the Project Setup dialog box, select Miscellaneous, then click Register Maps.

This will populate the maps table. Maps can also be indexed and managed by MSGG through a key map.

2.3.2.4 MSGG table synchronization

MSGG has additional tables which will not be populated when importing data or populating the main tables in the database environment. In this event, the Verify Tables utility must be used.

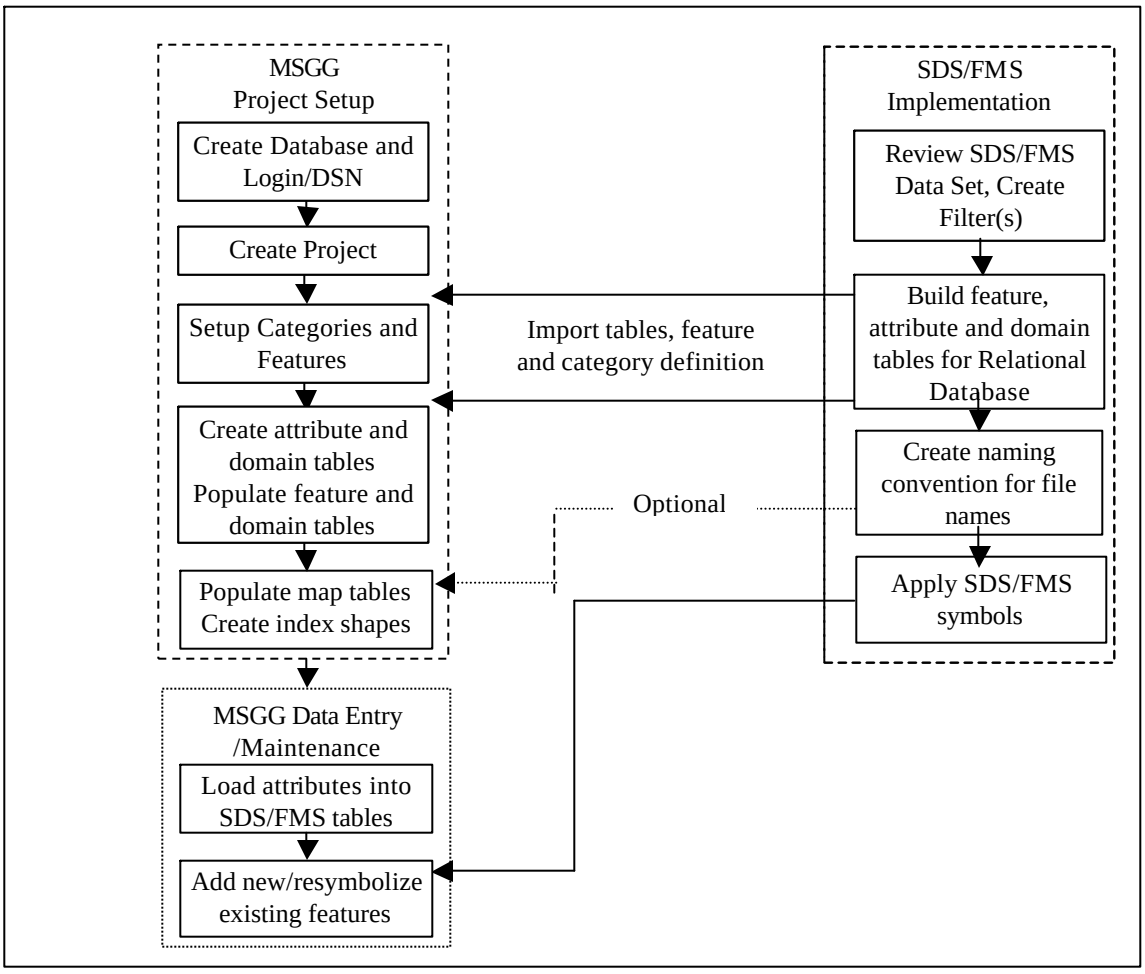


- From the Project Setup dialog box, select Miscellaneous, then click Verify Tables.

- Check all boxes and hit Verify. MSGG will populate all required fields.

3 SDS/FMS Application and Data Setup

This chapter describes how to properly use the SDS/FMS utilities for an MSGG dataset. The following chart shows the relationship between MSGG Project Setup and SDS/FMS Implementation steps (see Figure 1).



MSGG SDS/FMS Implementation Diagram

There are four key elements to applying the SDS/FMS:

- Create the category, feature, attribute and domain tables and export them into the MSGG database.
- Create features from existing elements and resymbolize the elements according to their feature definition.
- Load existing attribute data into SDS/FMS tables or manually enter the attributes into tables created with the SDS/FMS generate utility.
- Use the level structure and symbology defined and delivered with the SDS/FMS.

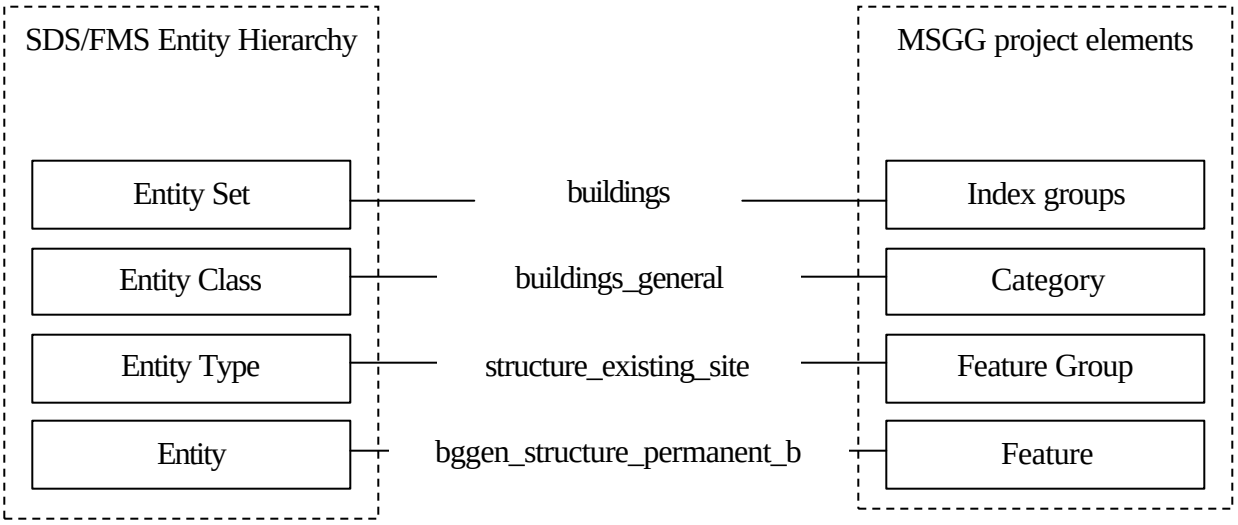
3.1 SDS/FMS Setup Steps for MSGG:

The following procedure uses an example with a selected Entity Class: building_general which is the placeholder for buildings. The data, such as MicroStation design files, for buildings and attributes that describe these buildings are assumed to be structured and properly linked.

3.2 Implementation Preparation and Schema Selection

First, a general concept for the GIS model of the existing features and the nature of the Standards both have to be understood. It is important to note that the SDS/FMS does not specify the model, but defines the naming, the symbology and the way the attributes are stored. The GIS model itself is largely determined by the application: MSGG. The Standards provide a common platform, which will facilitate simple conversion and a one-to-one match of features between SDS/FMS compliant implementations.

The following chart shows the relationship between the MSGG project elements and the SDS/FMS entity hierarchy



The user can apply and implement the SDS/FMS manually or by using the SDS/FMS supplied setup tools. The following is a step-by-step example for setting up and browsing the SDS/FMS data. Browsing the SDS/FMS allows the user to become familiar with the standards and prepare to create a filter.

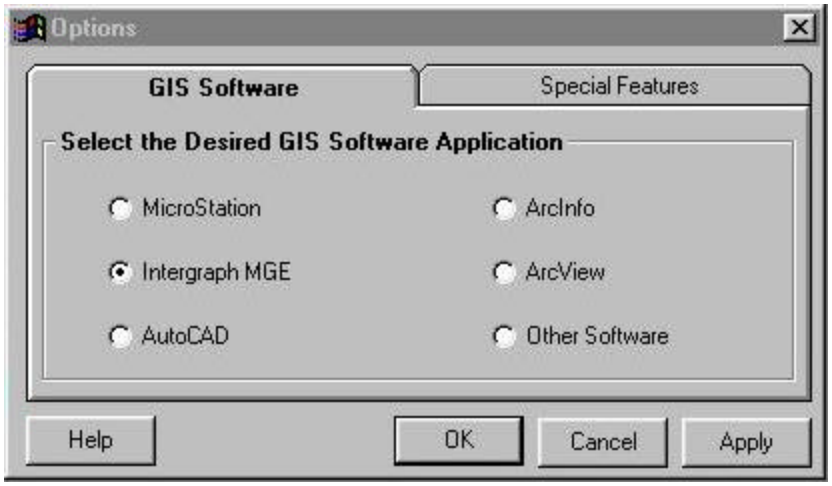
3.2.1 Select "SDS/FMS Browser" from the Windows Start Menu

3.2.2 Configure the Browser Data Connections

- From the SDS/FMS menu, select Connect.
- Verify and change, if necessary, the locations of the SDS/FMS files.

3.2.3 Configure the SDS/FMS options

- From the SDS/FMS menu, select Options.
- Select Intergraph MGE, then click Apply.
- Select the desired special features and output file path, then click OK.

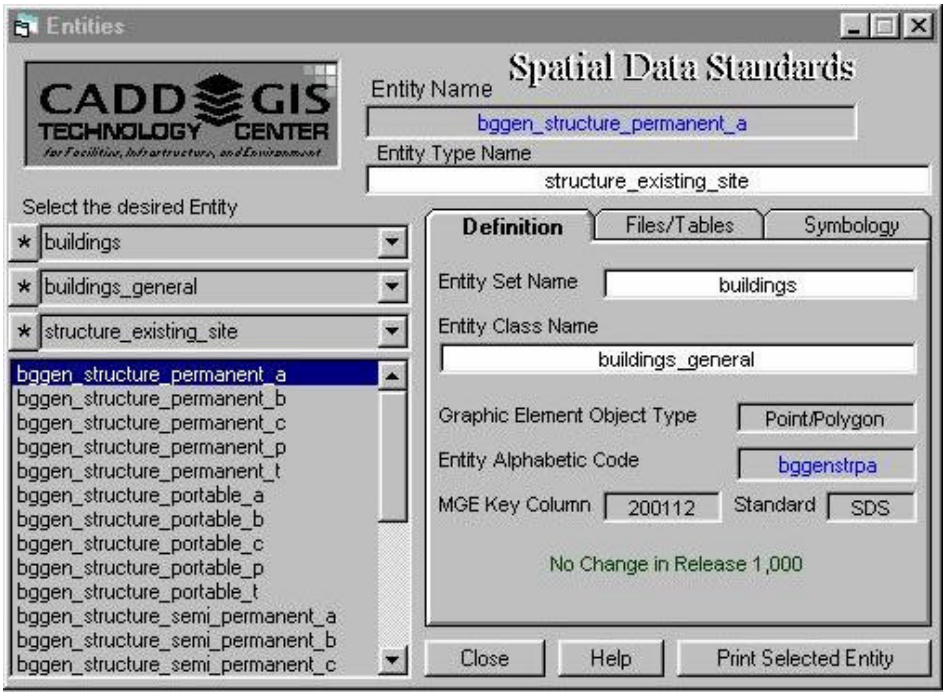


3.2.4 Browse the SDS/FMS to determine all the Entity Classes in the "Buildings" Entity Set

- From the Browse menu, select By Structure.
- Click the Entity bar and change "All Entity Sets" to "Buildings" in the Entity Set window.
- Double-click on the buidlings_general entity class name.
- A new window will be invoked with Entity Classes.
- Double-click on buildings_general in the list on the left.

- Another new window will be invoked with Entity Types.
- Double-click on structure_existing_site.

This will display the Entities form shown below.



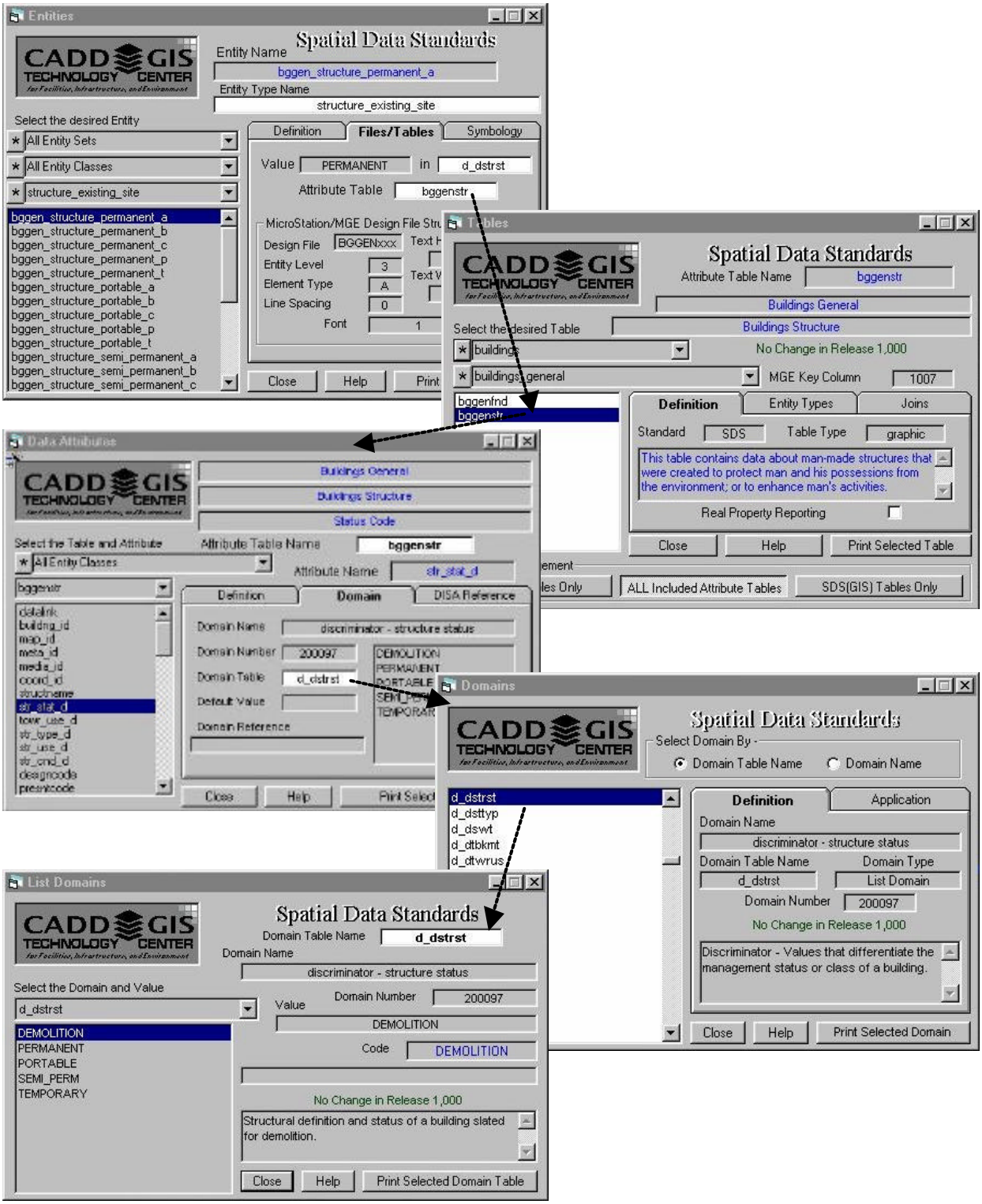
Check the different tabs (Defintion, Files/Tables, and Symbology) to review the characteristics of the Entity. As shown in the previous example, a useful review feature is double-clicking on any of the fields with white (active) background. This will invoke forms with data from parent or child elements in the SDS/FMS hierarchy.

E.g., the entity bggen_structure_permanent_a has its attributes stored in table: bggenstr. The table's structure, domain values, and domain tables can be reviewed by following the definition links in the figure below.

Note that the SDS/FMS naming accomodates and indicates the various element types in MSGG.
The suffix indicates the following types.

_a	Attribute
_b	Polygon
_c	Centroid
_p	Point
_t	Text

The feature, when created in MSGG, will automatically become the specified element as it is defined in the feature table.


Entities
Spatial Data Standards
CADD GIS TECHNOLOGY CENTER
Entity Name
bggen_structure_permanent_a
Entity Type Name
structure_existing_site
Select the desired Entity
All Entity Sets
All Entity Classes
structure_existing_site
bggen_structure_permanent_a
bggen_structure_permanent_b
bggen_structure_permanent_c
bggen_structure_permanent_p
bggen_structure_permanent_t
bggen_structure_portable_a
bggen_structure_portable_b
bggen_structure_portable_c
bggen_structure_portable_p
bggen_structure_portable_t
bggen_structure_semi_permanent_a
bggen_structure_semi_permanent_b
bggen_structure_semi_permanent_c
Definition
Files/Tables
Symbology
Value PERMANENT in d_dstrst
Attribute Table bggenstr
MicroStation/MGE Design File Stru
Design File BGGENxxx
Entity Level 3
Element Type A
Line Spacing 0
Font 1
Close
Help
Print
Tables
Spatial Data Standards
Attribute Table Name bggenstr
Buildings General
Buildings Structure
No Change in Release 1,000
Select the desired Table
buildings
buildings_general
MGE Key Column 1007
bggenfnd
bggenstr
Definition
Entity Types
Joins
Standard SDS
Table Type graphic
This table contains data about man-made structures that were created to protect man and his possessions from the environment; or to enhance man's activities.
Real Property Reporting
Close
Help
Print Selected Table
ALL Included Attribute Tables
SDS(GIS) Tables Only
Data Attributes
Buildings General
Buildings Structure
Status Code
Select the Table and Attribute
Attribute Table Name bggenstr
All Entity Classes
Attribute Name str_stat_d
bggenstr
datalink
building_id
map_id
meta_id
media_id
coord_id
structname
str_stat_d
tower_use_d
str_type_d
str_use_d
str_cmd_d
designcode
presntcode
Definition
Domain
DISA Reference
Domain Name discriminator - structure status
Domain Number 200097
Domain Table d_dstrst
Default Value
Domain Reference
DEMOLITION
PERMANENT
PORTABLE
SEMI_PERM
TEMPORARY
Close
Help
Print Select
Domains
Spatial Data Standards
Select Domain By -
Domain Table Name
Domain Name
d_dstrst
d_dsttyp
d_dswt
d_dtlbkmt
d_dtwrus
Definition
Application
Domain Name
discriminator - structure status
Domain Table Name d_dstrst
Domain Type List Domain
Domain Number 200097
No Change in Release 1,000
Discriminator - Values that differentiate the management status or class of a building.
Close
Help
Print Selected Domain
List Domains
Spatial Data Standards
Domain Table Name d_dstrst
Domain Name
discriminator - structure status
Select the Domain and Value
d_dstrst
Value
Domain Number 200097
DEMOLITION
PERMANENT
PORTABLE
SEMI_PERM
TEMPORARY
DEMOLITION
Code DEMOLITION
No Change in Release 1,000
Structural definition and status of a building slated for demolition.
Close
Help
Print Selected Domain Table

Before the user becomes familiar with the naming code, the entities can also be located by using the Feature or the Keyword browser.

- From the Browse menu, select By Feature.
- Find "Building" and double-click.
- Double-click on "PERMANENT" in the "Select the Feature Modifier" window.
- A new Feature window will be invoked.
- Double click on the structure_existing_site Entity Type name.
- A new Entity Types window will be invoked.
- Double-click on structure_existing_site in the list on the left.

The Entities window will be invoked for entity bggen_structure_permanent_a as was found in the by browsing by structure steps above.

3.3 Schemas/Filter Creation

New to Release 1.9 of the SDS/FMS are the Filter Maker and Filter Eraser functions. Filter Maker permits the development, definition, modification, implementation, and saving of a single Custom Filter per SDS/FMS Library. A filter is a subset of features used to limit the volume of material used from the SDS/FMS. Filters limit all aspects of the SDS/FMS including Entity Sets, Classes, and Types, as well as Tables, Attributes, and Domains. A custom filter is a user-defined filter. Although the creation of a custom filter is optional, it will greatly facilitate the SDS/FMS database generation process and is therefore highly recommended.

In the following example, a sample filter will be built.

3.3.1 Select SDS/FMS Filter Maker

Select SDS/FMS Filter Maker from the Windows Start menu or double-click on the file TSSmaker.exe in the TSSDS directory.

3.3.2 Connect to the SDS Library.

This process is the same as that of the

SDS/FMS browser.

- Click "Connect to SDS Library."
- Go to the directory that holds your SDS/FMS browser, choose the "Release.190" directory and click "Connect, Test, and Save."

Once you connect to the SDS/FMS database, you may proceed to the next step.

3.3.3 Naming and/or retrieving an existing filter

- In the box provided to you, type in the word "MSGG Sample." Click Next.

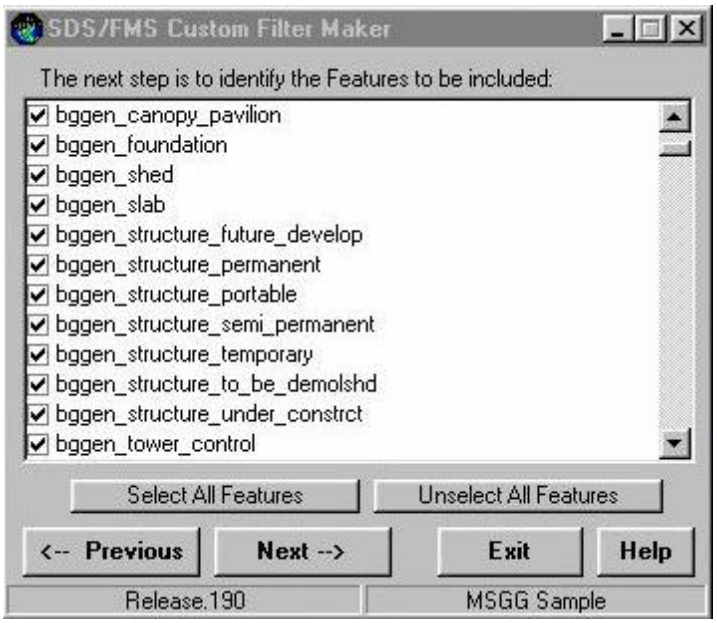
3.3.4 Saving the Results for Future Use

- Click the "Save Filter File Name Assignment" button and save MSGG.sdf in an appropriate file directory. (It is suggested that it be saved in the SDS/FMS directory.)
- Click Next.

3.3.5 Selecting the Features in the Filter

At this point the filter maker will provide the user with a list of all SDS/FMS features that are available to put into their custom filter. A user has three options here: Select All Features, Unselect All Features, or select individual features using the check box by the feature names.

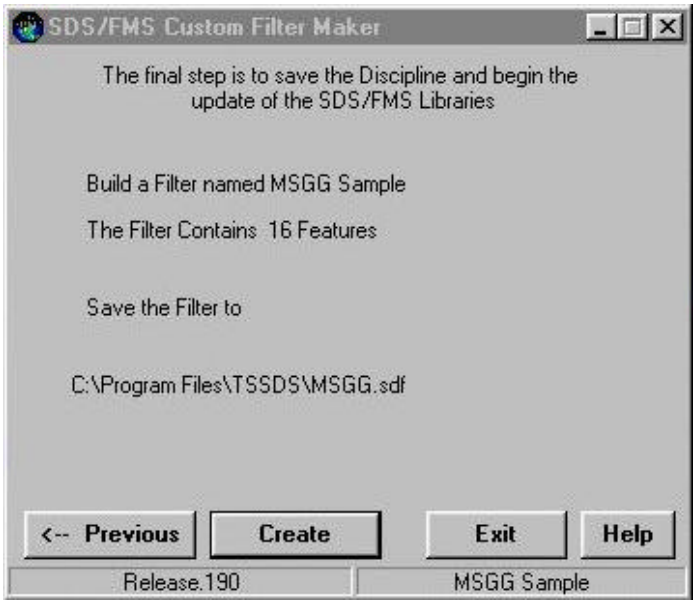
- For the purposes of this exercise, select all of the features that begin with "bggen" (for buildings), then click Next.



If the information on the screen is correct, click the Create button. (It will take a while for the filter to be created.) You should see the following:

- Build a filter named MSGG Sample.
- The filter contains 15 features.
- Save the filter to your chosen directory.

Once the filter generator has completed, open your SDS/FMS Browser and "MSGG Sample" should be an available choice from the Filters menu.



3.4 SQL Script/ Access Database Generation

The actual implementation of the SDS/FMS begins with generating tables and definitions. The user has the option to generate database schema in various forms by using the following options:

- The entire SDS/FMS schema
- Custom filter schemas
- Single table schemas
- Entity Set schemas
- Entity Class schemas

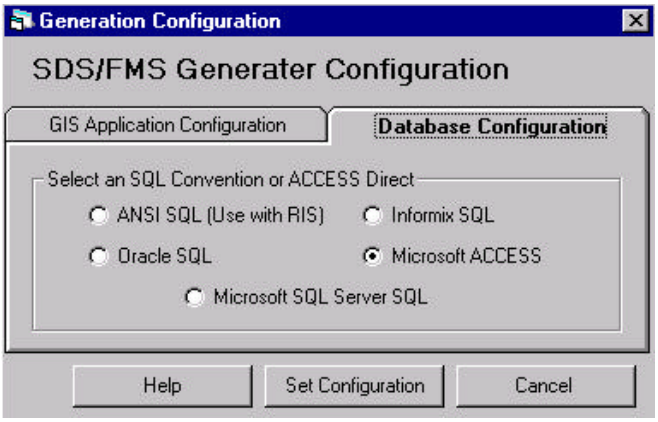
The user also has the choice of creating SQL Script (for Oracle, SQL Server, or Informix) or of creating Access Database tables. For this example, the custom filter schema method for an Access Database will be used. See the online help in the SDS Generator's help file for more information on the other methods. The Generator allows the user to create the following user-specified items:

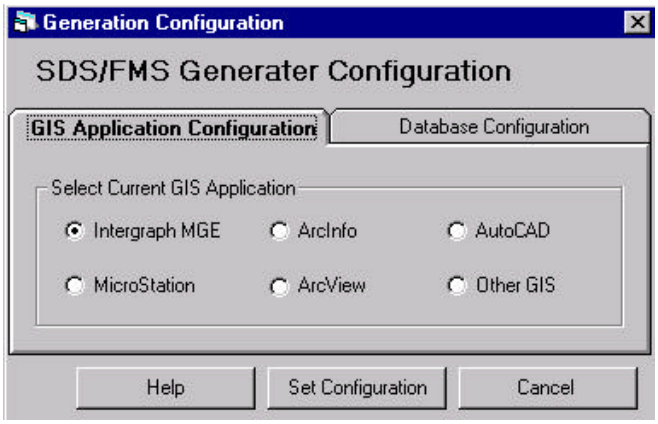
- Tables and attributes
- Domains and values
- Relationships and joins

The following steps will generate the Access database tables for the "MSGG Sample" filter.

3.4.1 Select SDS/FMS Generator…

Select SDS/FMS Generator from the Windows Start menu or double-click on the TSSDSGen.exe in the TSSDS directory. Connect to the SDS/FMS database as in previous examples.





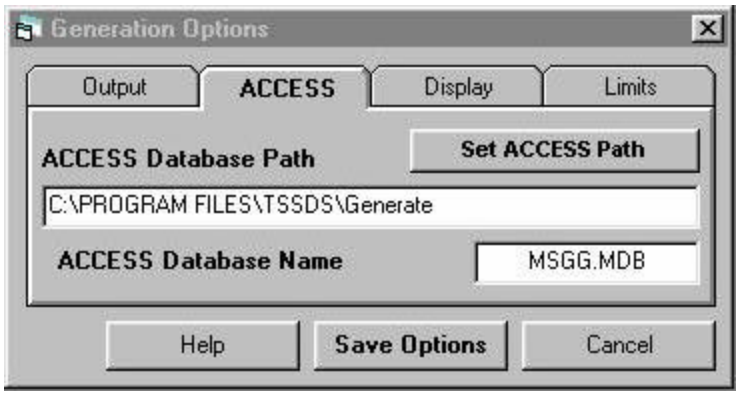
3.4.2 From the SDS/FMS menu, choose Configuration …

From the SDS/FMS menu, choose Configuration. Under the GIS Application Configuration tab select Intergraph MGE, and under the Database Configuration tab, select Microsoft Access. Click "Set Configuration."

3.4.3 From the SDS/FMS menu…

From the SDS/FMS menu, select Generation Options. Under the Access tab, the name of the Access database should be changed to "MSGG.MDB." Click "Save Options."

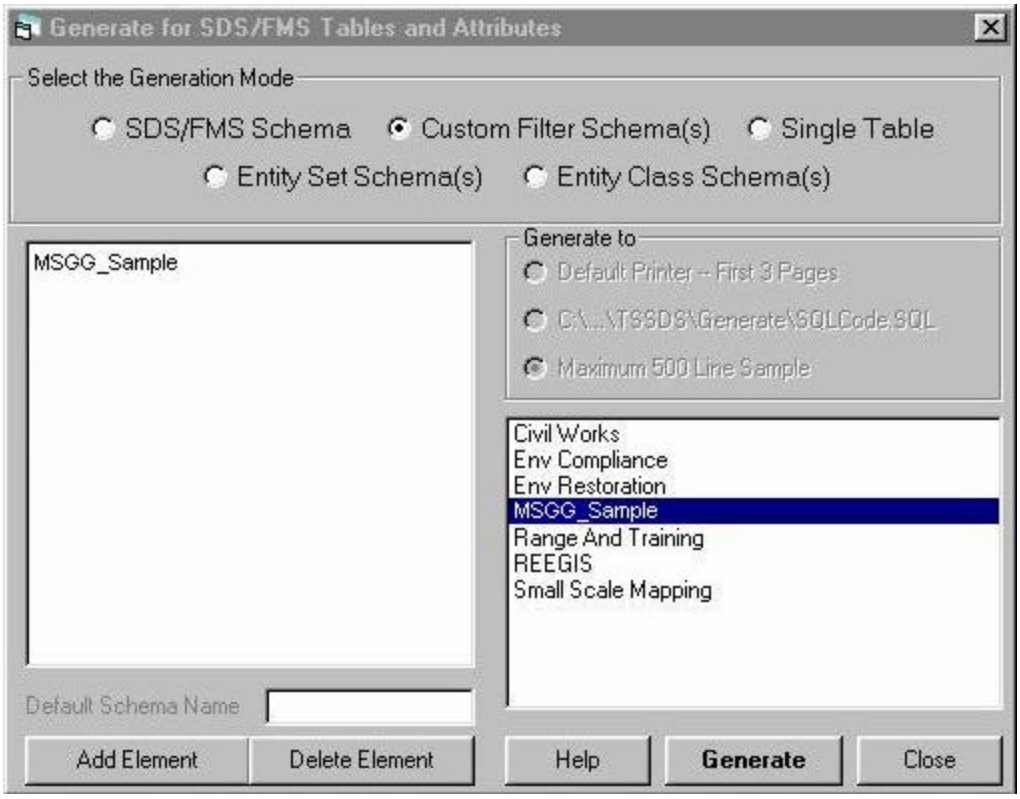
Alternatively, if a database other than Access had been selected (Oracle, Informix, SQL Server), an output file name for the SQL Script must be provided. When other RDBMS is used (Oracle, Informix, etc.) Under Output, enter the name of the SQL output file name to be created. In order to create the database tables, this SQL script must be run from within the specific database environment.



3.4.4 From the Generate menu, select New, then Tables and Attributes

- Select Custom Filter Schema(s).
- MSGG_Sample should be available in the list. Highlight and click "Add Element."

MSGG_Sample should now be in the large box on the left of the screen; click "Generate". Once this process is completed you will have an Access database with the blank tables and attributes.



Currently, in this version of the SDS/FMS, the domain tables cannot be generated for Access with the MGE settings. For the following step, the GIS Application Configuration has to be used set for MicroStation (see step 2).

3.4.5 From the Generate menu, select New, then Domains and Values

- "Add to Existing Database" should be selected; click Generate.
- Select "MSGG.mdb" and click Open.
- Click Close.

Once this process is completed the domains and values are added to the MSGG sample database. Only the domains for the already created attribute tables will be generated.

Note: The user can create a separate database for the domains and values, but it is recommended that the user create a single database.

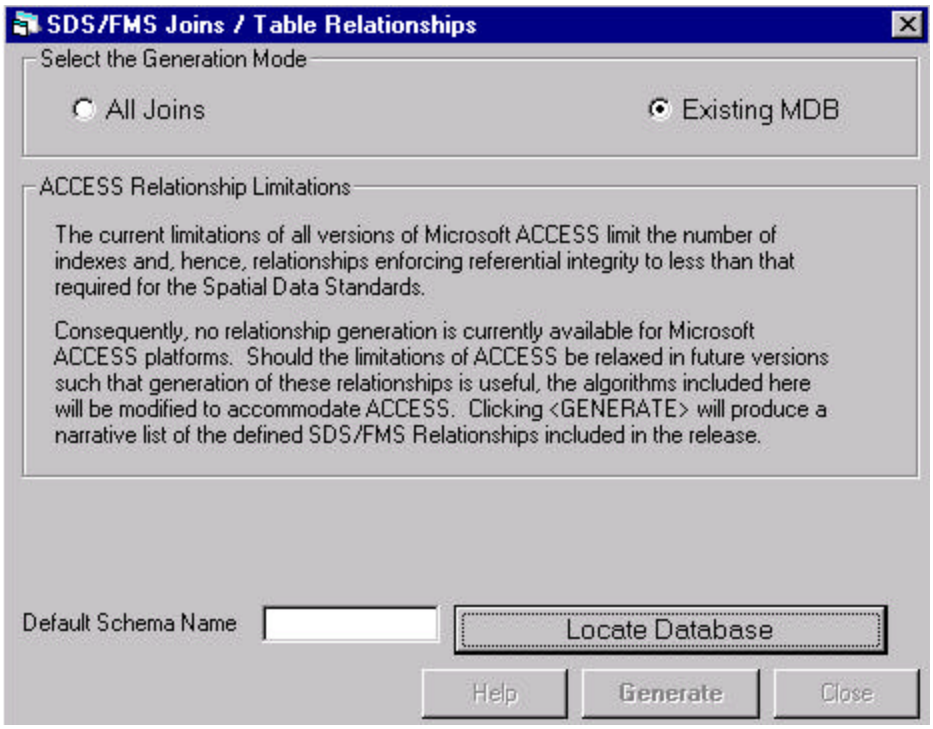
Due to the current limitations of Microsoft Access the Joins cannot be added to the database. However, a narrative text file listing the links will be created and deposited into the home directory. These joins can be linked manually in Access but are not needed for implementation. The user may choose the joins that they believe necessary and join them manually.

3.4.6 From the Generate menu, select New, then Relationships/Joins

- Select "Existing MDB."
- Click on Locate Database and select "MSGG.mdb."
- Click "Generate."

All the tables and definitions are now available for continuing the MSGG project setup.

In this Release 1.90 of the SDS/FMS, the Category and Feature tables are not created for Microsoft Access with the Generator. This is crucial and should be added to the Standard's tools in future versions. Currently, an SQL script must be generated for the selected Filter and run as an Access query to populate the Category and Feature table.



The following steps should be performed to populate these tables:

- From the SDS/FMS menu, choose Configuration. Under the GIS Application Configuration tab select Intergraph MGE, and under the Database Configuration tab, select Oracle SQL.
- Continue with step 4., select the appropriate Filter, then click "Generate.

A text named SQLCode.txt file will be created in the default ..\TSSDS\Generate directory.

- Open this file with a text editor.
- Open the MSGG.mdb Access database.
- Create a new query and view it in SQL view.
- Cut and paste the "insert…" lines (see example below) into the Query and under Tools, hit "Run"

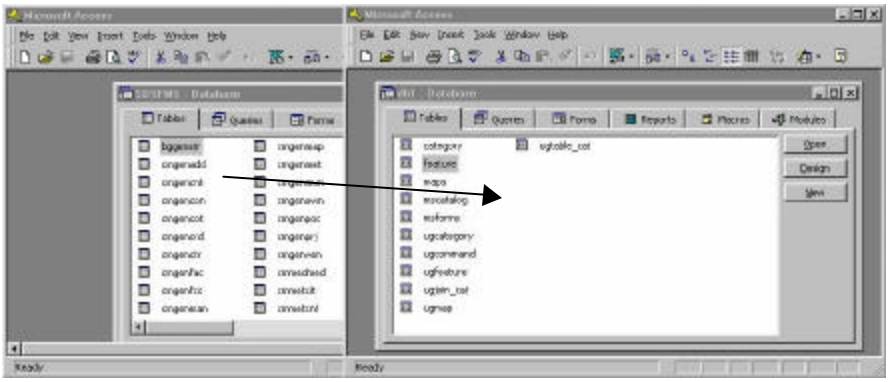
```
insert into category (mslink, cname,
indextype)values(200003,
'buildings_general', 'tiled');

insert into feature (mslink, fcode,
fname, category, tablename, ftype,
flevel, fstyle, fweight, fcolor, digcmd,
fheight, fwidth, ffont, fjustification,
celllibrary, fcellname, cellscale) values
(200099, 'bggenfndat',
'bggen_foundation_t', 200003, null, 0,
40, 0, 1, 3, 'place text', 16, 16, 1,
'CC', 'N/A', null, 0);
```

This step will insert the SDS/FMS generated rows into the Category and Feature tables.

4 Updating and Setting up the MSGG database

4.1 Migrate/Import SDS/FMS Tables and Definitions

The next process in the implementation process is to migrate the SDS/FMS tables into the MSGG database. The tables can simply be dragged and dropped or imported through the Get External Data utility in Access.



4.2 Populate the Attribute Tables

If attribute data existed, it can be read/imported into the SDS/FMS table.
The following rules must be understood:

- The MSLINK field always has to be populated and has to be unique.
- Domain values have to be selected from the pull-down fields (automatically setup by the SDS/FMS Generator.

bggenstr : Table

mslink	buildng_id	map_id	structname	str_stat_d	str_type_d	heattype_d	no_occup	areainside	ar
1	001	2		PERMANEN	OFFICE	HTW_CHW	120	20000	
2	002	2		PERMANEN	OFFICE	HTW_CHW	105	21000	
3	003	2		PERMANEN	WAREH(	LTW	5	80000	
4	004	14		PERMANEN	TBD	LTW_CHW	25	6000	
5	005	14		PERMANEN	OFFICE	LTW	170	40000	
6	007	14		PERMANEN	OFFICE	S_CHW	32	9500	
7	008	14		PERMANEN	OTHER	S_CHW	6	30000	
8	009	16		PERMANEN	WAREH(	S_CHW	2	50000	
9	009	16		PERMANEN	OFFICE	LTW	58	14000	

Record: 7 of 9

4.3 Update System Tables

4.3.1 Update mscatalog

The names of the new attribute tables need to be entered into the mscatalog table for MSGG to recognize them. Note that if the elements had attribute tables linked to imported data, the same ENTITYNUM has to be used. When attributing data in the MSGG environment, linkages to the tables will be coded automatically.

The mscatalog table is the main system metadata table for the MSGG project database. It stores all table names and their attributes with the following mandatory fields:

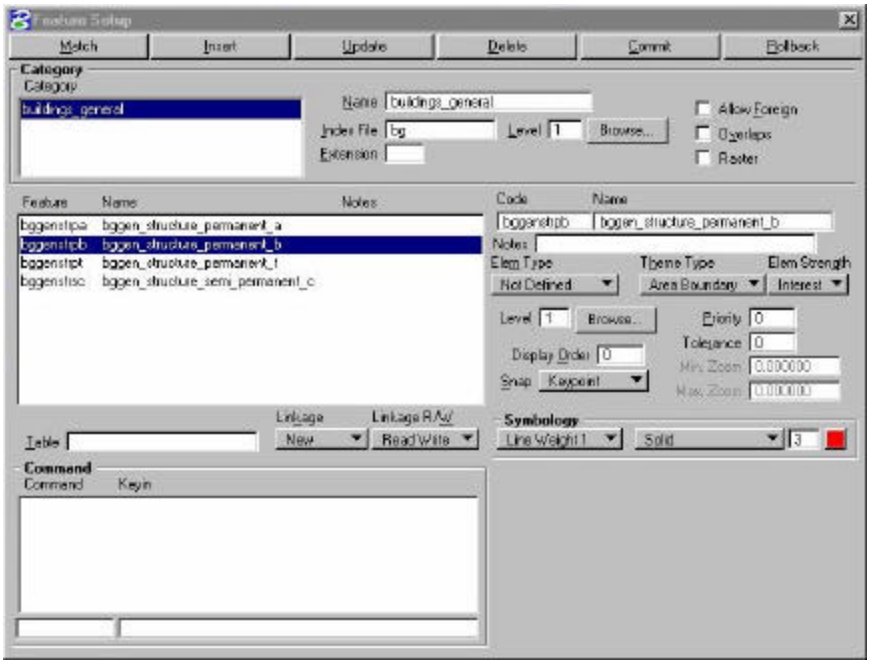
TABLENAME – The tablename column in MSCATALOG contains the names of all tables in the database that are to be linked to elements. The table names must be added to the tablename column before linkages to elements can be made.

ENTITYNUM – This is the ID field which links the attribute table to the elements in the design file. When retrieving the attribute information for an element, the element's ENTITYNUM value is used to find the tablename. The correct row in the table is idenitifie by the element's unique MSLINK value.

Both the TABLENAME and the ENITYNUM have to be unique.

4.3.2 Category and Feature Table Setup

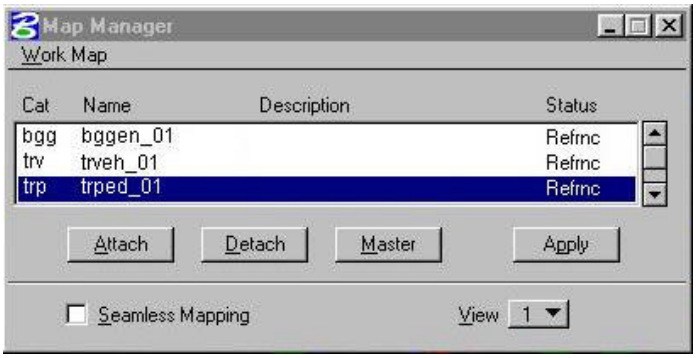
If the Category and Feature data has been imported correctly, the following information will be in the Feature Setup dialog. The dialog can be opened in the MSGG environment as desribed in 2.3.2.2.



4.4 Add feature and attribute linkages

The following steps describe procedures in the MSGG environment. Once the project has been setup and opened, the map (design file) to be edited must be activated through the Map Manager dialog:

- Select Map Manager under Utilities.
- From the list of maps in the dialog, select the appropriate map.
- Click Master, then Apply.
- The maps will be reattached, and the selected design file will become the master file.

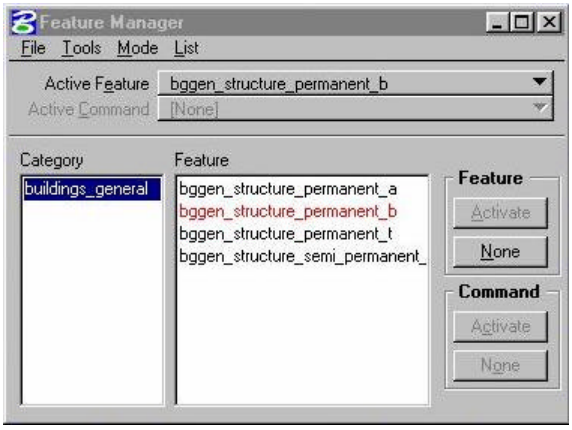


4.4.1 Add feature linkages

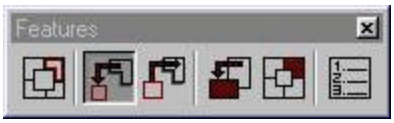
First, the appropriate feature linkages have to be attached to the elements.

Set a feature to be associated with elements:

- Under the Utilities menu, select Feature Manager.
- Select bggen_structure_permanent_b and click activate.



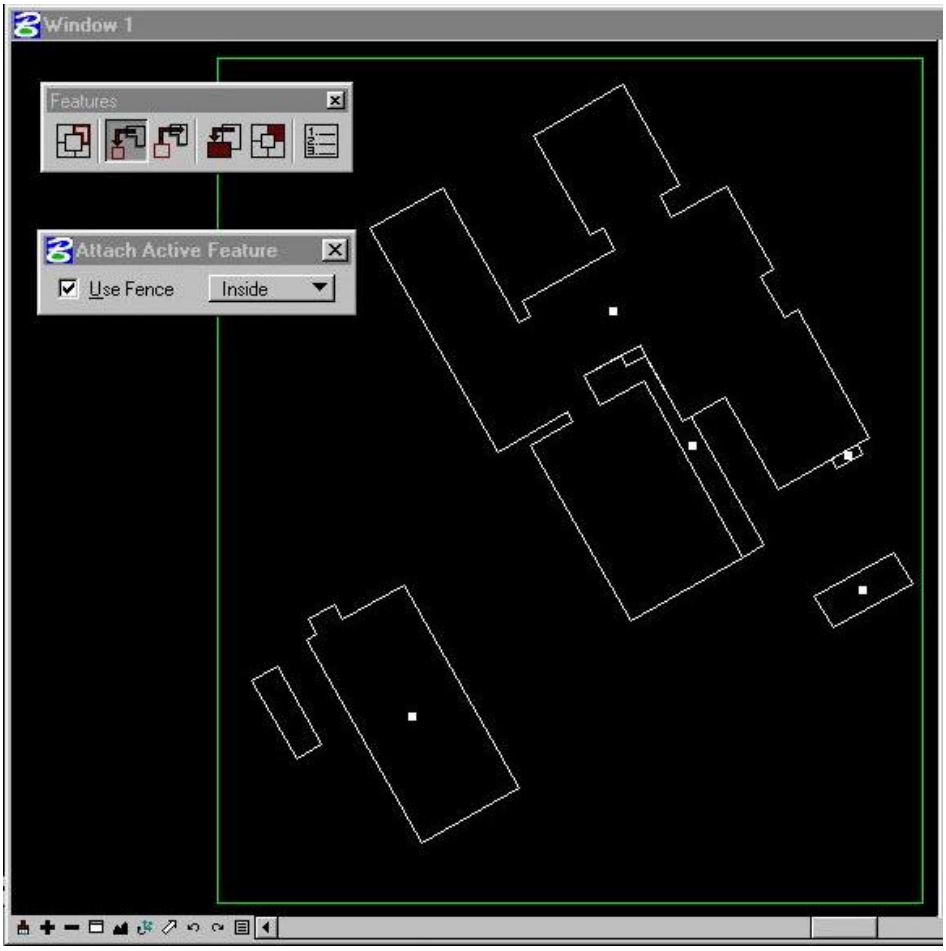
Open the Features toolbar.



Use the "Attach active feature to elements" tool.
This can be used in Fence mode.

- Place a fence around the elements to be processed.
- Click "Attach active feature to elements" tool.
- Set "Use Fence."
- Click in the view to run the command.

This will resymbolize the element according to the feature definition. Note that when a new feature is placed it will automatically have the symbology as defined in the feature table.



4.4.2 Resymbolize existing features according to SDS/FMS definition

This procedure should be used when elements have been previously associated with feature linkages, but they do not have the proper symbology.

Use the "Sync element with its feature definition" tool.
This can be used in Fence mode.

- Place a fence around the elements to be processed.
- Click “Sync element with its feature definition” tool.
- Set “Use Fence.”
- Click in the view to run the command.

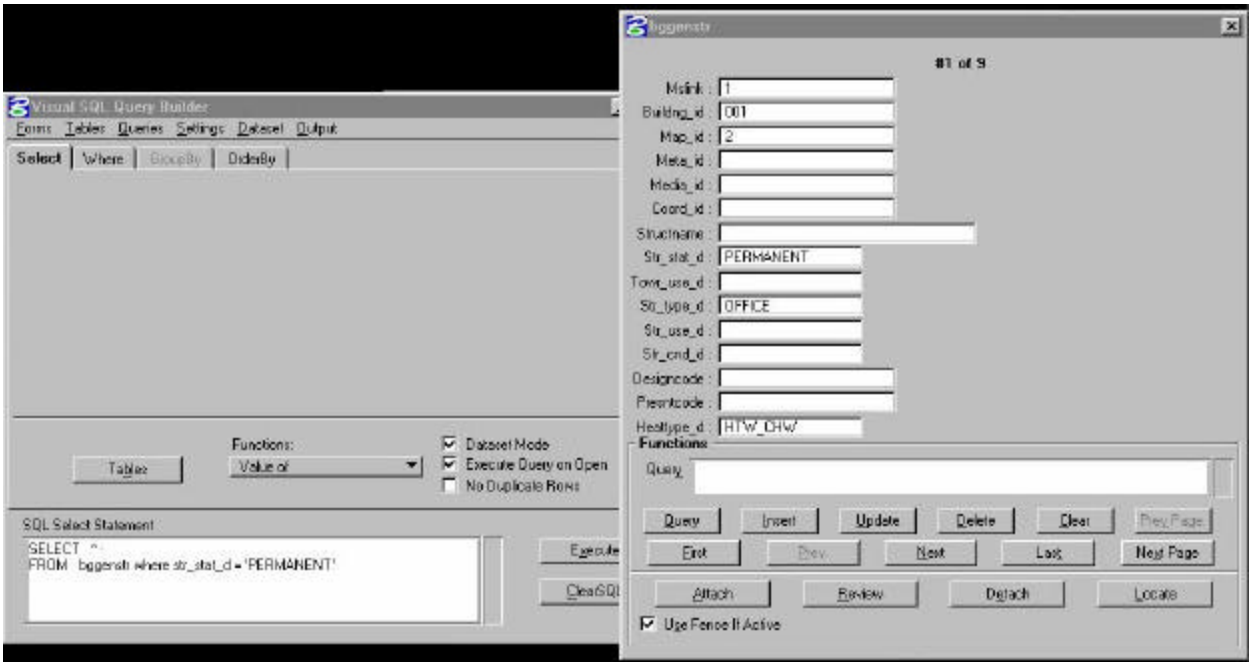
This will resymbolize the element according to their existing feature linkages.

4.4.3 Attach attribute linkages

If attribute data was populated from the database:

There are several ways to attach a linkage. The following example uses the standard dialogs:

- Open Visual SQL Builder (VSQL); under the Database menu, select SQL Query Builder.
- Enter the following statement: Select * from bggenstr where [specify criteria]
- Click Execute. This will invoke the database form with the first row found from the rows met the criteria.
- Click next until the desired row is found.
- Click Attach.
- Select the element in the view to attach the linkage to.



If attributes are entered from the MSGG environment:

- In the VSQL review window, enter a new record.
- Click Insert.
- Click Attach.
- Identify feature to attach the attribute record to.

4.5 Directory and File Naming

The SDS/FMS does not specify how to organize the graphic data when the same feature is presented on multiple maps. It is advisable that the user establishes a directory structure to help organize large data sets. Only the design file name prefixes that are defined for SDS/FMS Entities – grouped by Entity Classes are applicable in MSGG. (In, the current SDS/FMS version 1.9, five character entity class abbreviations are specified for the file names, such as "BGGENxxx", which allow for further project-specific classification.) However, each dataset may require identification in a project-specific directory structure; and, therefore, the SDS/FMS map names will have to be modified to identify more than the Enity Class only, such as grouping by geography.

For example, if the maps are organized by counties, each county will have a "trveh.dgn" (transportation_vehicle) file, which will not identify the files uniquely and which may cause problems when transferring files under the same name. By creating a directory for each county, the files will be separated in this example, and, by adding a suffix, such as "_01", "_02", "_GA", "_SC." The following sample file names will be unique and will describe their spatial characteristics.

BGGEN_01.dgn – buildings, tile 1
BGGEN_02.dgn – buildings, tile 2

Both the graphic and attribute data are now in SDS/FMS format.

4.6 Apply the SDS/FMS symbols.

The SDS/FMS symbols can applied to the graphic data by placing the delivered cell library in the cell directory. When a new feature is placed, the appropriate cell will be used according to the feature definition.

In order to enable MSGG to use the proper cells, the SDS/FMS cell library has to be attached, described in the following steps:

In the Project Setup dialog, under Tables, select Feature Setup.

The Feature Setup dialog box will be invoked.

- From the Element Type option menu, select Cell.
- Cell feature settings appear in the right hand corner of the Feature Setup dialog box.
- Define the cell feature settings for:
- Library -- Identifies the cell library.
- Name -- Identifies the name of the cell.
- Scale -- Sets the physical size of the cell. The default scale size is 1.0000.
- Click Update to define the feature. Click Commit to save the feature.